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Laparoscopic repair of perforated peptic ulcer: Patch versus simple closure

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ABSTRACT

Background: Laparoscopic correction of perforated peptic ulcer (PPU) has become an accepted way of management. Patch omentoplasty stayed for decades the main method of repair. The goal of the present study was to evaluate whether laparoscopic simple repair of PPU is as safe as patch omentoplasty.
Methods: Since June 2005, 179 consecutive patients of PPU were treated by laparoscopic repair at our centers. We conducted a retrospective chart review in December 2012. Group I (patch group) included patients who were treated with standard patch omentoplasty. Group II (non-patch group) included patients who received simple repair without patch.
Results: From June 2007 to Dec. 2012, 179 consecutive patients of PPU who were treated by laparoscopic repair at our centers were enrolled in this multi-center retrospective study. 108 patients belong to patch group. While 71 patients were treated with laparoscopic simple repair. Operative time was significantly shorter in group II (non patch) ($p = 0.01$). No patient was converted to laparotomy. There was no difference in age, gender, ASA score, surgical risk (Boey's) score, and incidence of co-morbidities. Both groups were comparable in terms of hospital stay, time to resume oral intake, postoperative complications and surgical outcomes.
Conclusion: Laparoscopic simple repair of PPU is a safe procedure compared with the traditional patch omentoplasty in presence of certain selection criteria.

1. Introduction

The decline in the incidence of perforated peptic ulcer (PPU) over the past several years is attributed to the introduction of anti-ulcer medication and Helicobacter eradication therapy.[1,2] The influence of the pneumoperitoneum on the acute abdomen with peritonitis was unclear. However its usage in acute abdomen as a diagnostic tool and its therapeutic possibilities has been established.[3–5] Laparoscopic repair of perforated peptic ulcer represents an attractive option, because it allows to identify the site of perforation and closure of the perforation, just like the open repair but without large abdominal incision.[6,7]

Laparoscopic repair is known with its benefits including reduced postoperative pain, less pulmonary infection, shorter hospital stay, and earlier return to normal activities.[8] Graham omentoplasty is the default method of closure of peptic perforation. The rationale to add an omental patch is based on the assumption that it may decrease the probability of leakage and provide a further sense of security.[9] However, it is believed to be relatively time consuming and it requires extensive surgical skills. Simple suture repair of peptic ulcer perforation without using pedicled omentoplasty might significantly shorten operating time but the question remains if whether it is safe to abandon omentoplasty. In the current study, we aimed to specify if there is any difference between simple closure with or without an omental patch.

2. Methods

2.1. Patients

This is a multicenter retrospective study, from June 2005 to December 2012, all patients with diagnosis of perforated peptic ulcer who underwent laparoscopic repair were enrolled. The preoperative data collected were age, gender, American Society of Anesthesiologists Association Score (ASA), presence of shock, white blood cell (WBC) count, co-morbidities of the patients, and Boey risk factor.[10] Boey risk scoring system is well known for stratification of high risk patients in PPU. Major

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medical illness, preoperative shock, and longstanding perforation (more than 24 h) each scored if present The intraoperative data collected were Mannheim Peritonitis index (MPI),[11] location and size of perforation, amount of lavage fluid, type of repair, operative time. The Mannheim peritonitis index took age, gender, presence of organ failure, underlying malignancy, peritonitis over 24 h and severity of contamination in peritonitis into consideration. The postoperative data collected were length of hospital stay, time to resume oral intake, postoperative complications including leakage, wound infection, and intraabdominal abscesses.

2.2. Surgical technique

Patients were optimized preoperatively by intravenous fluids (IVF) nasogastric decompression, adequate analgesia and proper IV antibiotic. Entry to the peritoneal cavity was done using an open technique to create carbon dioxide pneumoperitoneum with pressure of 12 mmHg. Two 5-mm ports were inserted into the right and left upper quadrants of the abdomen, respectively. In thirteen patients, additional 5-mm ports were inserted in the right mid-axillary line to allow elevation of the liver. The surgeon and the camera operator stood on the patients' left side. Adequate position was obtained by tilting the operation table to the left side with elevation of the patient head (anti-Trendelenburg's position). Examination of the whole peritoneal cavity was done and the duodenal perforation was identified followed by obtaining culture material. The peritoneal cavity around the perforation site was irrigated with several liters of normal saline. The perforation was repaired with 2–3 pretaken polyglycolic sutures which were tied over an omental patch (108 patients). Simple repair was done following the same technique but lacking the omental patch (in 71 patients). The peritoneal cavity was irrigated with warm saline using a pressurized suction irrigation system, while special attention was paid to the right subphrenic, subhepatic and pelvic regions. A closed suction drain was left around the perforation site at the end of the operation. It was a surgeon's decision whether to do a simple closure of the perforation or to add an omental patch. However, all surgeons performed the operations with same technique.

2.3. Postoperative management

The patients were monitored by clinical progress data (vital signs, drains volume and fluid character, urine output and chest and abdominal examination). The same preoperative antibiotic and deep vein thrombosis (DVT) prophylaxis (enoxaparin sodium 40 mg subcutaneously daily) was continued in addition to IV proton-pump inhibitor (PPI) medication. Nasogastric tube (NGT) was removed once the bowel activity returned and daily volume of the aspirate was less than 200 ml. The patient was allowed to have sips of oral fluid initially and then graduate to full oral intake as he/she tolerated. Patients were discharged if they were pain free, without vomiting, had no drains and no NGT. Oral proton-pump inhibitor (PPI) medication was prescribed for eight weeks. The first follow-up at our outpatient clinic was one week after discharge, to remove the stitches or clips. Ultrasonography (U/S) was done for all patients. Upper gastrointestinal endoscopy was performed to assess healing of the ulcer and to evaluate the status of Helicobacter pylori infection. The H. pylori-positive patients were given a two-week course of triple therapy that included lansoprazole, amoxicillin and clarithromycin.

2.4. Statistical analysis

The statistical analysis of the data in this study was performed using the SPSS version 10. Analysis of data was by intention-to-treat. For continuous variables, descriptive statistics were calculated and were reported as mean ± SD. Categorical variables were described using frequency distributions. The Student's *t*-test for paired samples was used to detect differences in the means of numerical variables. Chi-square test was used for nominal variables and Fisher's exact test was used in cases with low expected frequencies. A p- value < 0.05 were considered to be significant.

3. Results

3.1. Preoperative findings

From June 2005 to December 2012, a total of 179 patients diagnosed to have PPU received emergency laparoscopic operations in our institutes were enrolled in this study. The patients' characteristics are shown in Table 1. There were 108 patients who received closure plus omental patch (group I) and 71 patients who received simple suture closure (group II). The majority of patients were male with mean age of 34 ± 12. 23 patients were above age of 70 years. The average time of presentation was 18 ± 3 h 85 patients gave history of previous ulcer history, 69 patients were smokers, 19 patients were alcoholics, and 49 patients had been given nonsteroidal anti-inflammatory drugs (NSAIDs) or steroids. There was no statistical difference between these 2 groups in terms of ASA classification. 11 patients in group I and 7 patients in group II presented with initial hypotension but all of them respond well to fluid resuscitation. There was also no statistical difference between these 2 groups considering their Boey risk factor scoring. We found 48 patients in group I and 21 patients in group II having co morbid diseases. Most of them were diabetes mellitus (DM) and hypertension (HTN).

Table 1
Demographic data.

Variable	Group I = 108	Group II = 71	*p* Value
Age (years)	32 ± 9	34 ± 11	0.8
Sex (F%:M%)	19%:81%	17%:83%	0.76
Ulcer history	59 (54.6%)	37 (52.1%)	0.9
NSAIDs	39 (36.1%)	23 (32.39%)	0.65
Smokers	47 (43.5%)	32 (45%)	0.8
Alcoholics	12 (11.1%)	7 (9.8%)	0.71
BMI (kg/m^2)	32 ± 8	29 ± 7	0.63
ASA Score	1.89 ± 0.62	1.93 ± 0.75	0.65
Symptoms (hours)	18 ± 7	17 ± 6	0.83
Mean SBP(mmHg)	98 ± 23	97 ± 19	0.74
Mean DBP(mmHg)	65 ± 12	63 ± 9	0.69
Mean pulse (min)	83 ± 24	81 ± 19	0.82
Body Temp. (°C)	37.5 ± 1.2	37.6 ± 1.2	0.78
Boey score	–	–	–
Score 0	68(62.9%)	42(59.3%)	0.72
Score 1	26(24%)	19(26.7%)	0.83
Score 2	14(13.1%)	10(14%)	0.91
Mean WBCs ($\times 10^3$/cm^3)	10.2 ± 4.2	11 ± 5	0.7
Co-morbidities	32 (29.6%)	16 (22.5%)	0.64
DM	17	9	–
HTN	9	4	–
IHD	4	3	–
COPD	6	3	–
Liver cirrhosis	3	1	–
Heart failure	1	0	–

NSAIDs, nonsteroidal anti-inflammatory drugs; body mass index, BMI; American Society of Anesthesiologists Association Score, ASA; systolic blood pressure, SBP; diastolic blood pressure, DBP; white blood count, WBC; diabetes mellitus, DM; hypertension, HTN; ischemic heart disease, IHD; chronic obstructive pulmonary disease, COPD.

3.2. Intraoperative findings (Table 2)

The majority of the ulcer perforations were small and located in the juxtapyloric region with no deference in distribution of perforation location. The mean size of perforation was 6 mm (4–17 mm). There was no difference between both groups regarding the size of perforation ($p = 0.08$). There was no statistical difference between the 2 groups for their MPI ($p = 0.48$). The operative time was significantly shorter in the non-patch group ($P = 0.01$).

Table 2
Intraoperative perspectives.

Variable	Group I = 108	Group II = 71	*p* Value
Mean perf. size	7 mm	7.5 mm	0.08
Small <5 mm	59 (54.7%)	42 (59.15%)	–
Medium5-10 mm	30(27.8%)	19(26.76%)	–
Large >10 mm	19 (17.5%)	10 (14.09%)	–
Location			–
Pyloric	17 (15.75%)	13 (18.3%)	0.81
Prepyloric	23 (21.29%)	13 (18.3%)	0.73
Postpyloric	68 (62.96%)	45 (63.4%)	0.91
Amount of lavage	2.3 ± 0.7 L	2.5 ± 0.8 L	0.93
Op. time (min)	73 ± 32	59 ± 19	0.01
Mean MPI	25 ± 6.3	23 ± 5.7	0.48

Mannheim Peritonitis index (MPI), operative (Op).

Table 3
Postoperative data.

Variable	Group I = 108	Group II = 71	*p* value
Oral intake (days)	3 + 1.2	3.2 + 1.3	0.6
Hospital stay(days)	5 ± 3.2	5.5 ± 3.6	0.7
Complications	17 (15.7%)	8 (11.27%)	0.73
Gastric stasis	5	2	–
Pneumonia	7	4	–
Port infection	0	0	–
DVT	0	0	–
Leakage	4 (3.7%)	3 (4.2%)	0.41
H-Pylori	56 (51.8%)	34 (47.9%)	0.82
Mortality	2 (1.85%)	1 (1.4%)	0.72

Deep vein thrombosis, DVT.

3.3. Postoperative findings (Table 3)

The hospital stay was similar ($p = 0.7$). Time to resume oral intake was also similar ($p = 0.6$). Postoperative complications occurred in 25 patients without significant difference between both groups; 7 patients had gastric stasis, 11 patients developed pneumonia. All patients were managed conservatively and they responded well to the medical treatment. There was no intra-abdominal presence of residual abscesses or wound infection in any. Three patients in group II and 4 patients in group I were complicated with leakage after operation, all of them were managed by reoperation. 2 patients of group I and 2 patients of group II who had leakage, they presented late, and one patient had perforation 14 mm. These 4 patients were managed by laparotomy and their perforation was corrected by omental patch and they passed the 2nd operation and were discharged later. The other 2 patients of group I and one patient in group II were very old and had multiple medical diseases and they presented very late after they started to have impaired organ functions before operation. Their general condition got worse after they developed leakage and did not recover from their complications and died after few days.

4. Discussion

Following the introduction of proton pump inhibitors, the role of surgery in the peptic ulcer disease is becoming limited mainly to management of the complications. Nevertheless, the role of acid reduction surgery becomes less important for the management of PPU.[12] Many studies confirmed safety and efficacy of the minimally invasive laparoscopic surgery in management of PPU.[13,14] However, most of them, their repair of the perforation was based on using the simple repair with pedicled omentoplasty. There are rare publications about laparoscopic repair of PPU without this omental patch. We aimed in our study to see if it is safe to repair these perforations with simple suture closure and if all patients are candidate for this technique or there are some patients to whom the omentoplasty is still necessary.

The idea behind necessity for omentoplasty is assumption that it has the advantage of preventing potential leakage and providing a further sense of security. Cellan-Jones[15] advised to prevent tearing out of sutures and prevent enlargement of the size of perforation by damaging the friable edges by placing a plug of pedicled omentum into the “hole” and secure this with three tie-over sutures. His technique is often called the Graham patch, but Graham describes in his article the use of a free omental plug, a technique that hardly any surgeon uses nowadays.[16]

Table 2 showed that both groups were similar regarding the intraoperative findings in terms of location and size of the perforations. MPI was used to compare the disease severity in peritonitis between both groups, and we found that both groups were also similar. So both groups were almost comparable in terms of both preoperative and intraoperative findings to a degree that makes their surgical outcomes comparable.

Our study showed that simple repair without omental patch significantly shortens the operative time. The reported rate of leakage for patients received emergency repair of PPU is high up to 26.8%.[17] Our leakage rate is 3.9%, these patients were very elderly and had multiple co morbidities, and the perforation was >1.5 cm. The explanation for this low leakage rate may be because most of our patients as candidate for laparoscopy, were early presenters, good general condition and they had low Boey’s score of surgical risk.

Because of laparoscopic repair of PPU is somehow complex and time consuming, many techniques were invented to simplify the procedure. Lau et al.[18] proposed repair of ulcer perforation using sutureless technique but it did not gain acceptance because of its high cost and high leakage rate. Siu et al.[19] obtained satisfactory results by closing the ulcer with a single stitch plus omental patch. Ates et al.[20] proved that laparoscopic simple closure without omental patch is safe and as effective as conventional open repair in patients with small perforated duodenal ulcer. Seelig et al.[21] did not use any selection criteria for laparoscopic repair without an omental patch, they observed one leak in the 21 patients in their study.

On the opposite, Turner et al.[22] reported that suture without an omental patch would result in a significantly higher mortality rate than with a patch. However, one of the explanations may be that most cases in their series were perforated gastric ulcers instead of juxta-pyloric perforation. Lunevicius et al.[23] reviewed 13 prospective and 12 retrospective studies and concluded that repair method should best be judged by the properties of the ulcer edge. Ates and Dirican[24] concluded that simple suture repair of PPU without omental patch is good option for repair based on criteria that include the duration of symptoms, mean MPI, ASA score and size of perforation. Our study confirms that using these criteria, it is safe to abandon omental patch repair to simplify the procedure and to shorten the operative time.

The weak point in this study is that it is retrospective non randomized. However, we used objective parameters to show that the two groups of patients were having similar surgical risks and disease severity. These parameters include age, gender, disease severity, Boey’s scoring system to stratify our patients based on their surgical risks, preoperative physical conditions using ASA score, in addition to presence of shock or not as well as their co-morbidities. We did not find statistical difference between both groups regarding all above mentioned parameters.

5. Conclusion

With certain selection criteria, laparoscopic simple suture closure of PPU is safe and effective. But application of the omental patch is still necessary for some other patients not fulfilling these criteria. Prospective randomized study is indicated to confirm the safety and effectiveness of this technique.

Ethical approval
None.

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Author contribution
Mohamed Abd Ellatif, Ayman Elezaby, Ahmed Hassan, Alaa Magdy, Emad Abdallah and Asaad Fayrouz performed the research, Mohamed Abd Ellatif and Asaad Fayrouz analyzed the data, Hitham

El-Kaffas designed the research, M Al-Katary and Mohamed Abd Ellatif, Hitham El-Kaffas wrote the paper.

Conflicts of interest

None.

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